

CLAIMS

We claim:

1. A substrate structure, comprising:
 - a substrate;
 - a solder mask formed over the substrate; and
 - a metal trace structure formed within the solder mask;
- 5 the metal trace structure including a channel therein for the receipt of underfill; the metal trace structure further including a central portion with arms radiating outwardly therefrom, dividing the solder mask into separate areas.
2. The structure of claim 1, wherein the arms each include a distal end.
3. The structure of claim 1, wherein the solder mask includes a series of solder bumps.
4. The structure of claim 1, wherein the solder mask includes a series of solder bumps not over the metal trace structure.
5. The structure of claim 1, wherein the metal trace structure is a cross shape or an X-shape.
6. The structure of claim 1, wherein the metal trace structure is a cross shape.

7. The structure of claim 1, wherein the arms each include a distal end wherein the distal ends of the respective arms receive the underfill.
8. The structure of claim 1, wherein the arms each include a T-shaped distal end wherein the T-shaped distal ends of the respective arms receive the underfill.
9. The structure of claim 1, wherein the central portion of the metal trace structure includes a shaft in communication with the channel.
10. The structure of claim 1, wherein the central portion of the metal trace structure includes a shaft in communication with the channel wherein the shaft receives the underfill.
11. A substrate structure, comprising:
- a substrate;
 - a solder mask formed over the substrate; and
 - a metal trace structure formed within the solder mask; the solder mask
- 5 including a series of solder bumps not over the metal trace structure;
- the metal trace structure including a channel therein for the receipt of underfill; the metal trace structure further including a central portion with arms radiating outwardly therefrom, dividing the solder mask into separate areas.
12. The structure of claim 11, wherein the arms each include a distal end.

13. The structure of claim 11, wherein the metal trace structure is a cross shape or an X-shape.
14. The structure of claim 11, wherein the metal trace structure is a cross shape.
15. The structure of claim 11, wherein the arms each include a distal end wherein the distal ends of the respective arms receive the underfill.
16. The structure of claim 11, wherein the arms each include a T-shaped distal end wherein the T-shaped distal ends of the respective arms receive the underfill.
17. The structure of claim 11, wherein the central portion of the metal trace structure includes a shaft in communication with the channel.
18. The structure of claim 11, wherein the central portion of the metal trace structure includes a shaft in communication with the channel wherein the shaft receives the underfill.
19. A method for underfilling a chip;
- providing a substrate;
 - forming a solder mask over the substrate;
 - forming a metal trace structure within the solder mask; the metal trace structure
- 5 including a channel therein for the receipt of underfill; the metal trace structure

further including a central portion with arms radiating outwardly therefrom,
dividing the solder mask into separate areas;

the substrate, solder mask and metal trace structure comprising a substrate
structure;

10 providing a chip having a series of solder bumps formed on the underside of
the chip; the solder bumps being arranged in a pattern including openings;

placing the underside of the chip onto the substrate structure wherein the
openings in the solder bump design overlie the substrate structure's metal trace
structure; and

15 introducing underfill into the metal trace structure so that the underfill flows
from the metal trace structure between the solder bumps in the solder bump
design to underfill the chip.

20. The method of claim 19, wherein the underfill flows from the metal trace
structure channel in the respective arms towards the outer portions of the chip.

21. The method of claim 19, wherein the arms each include a distal end.

22. The method of claim 19, wherein the metal trace structure is heated to a
temperature of from about 25 to 90°C before the introduction of the underfill into
the metal trace structure.

23. The method of claim 19, wherein the arms each include a distal end wherein the
distal ends of the respective arms receive the underfill.

24. The method of claim 19, wherein the central portion of the metal trace structure includes a shaft in communication with the channel.

25. The method of claim 19, wherein the central portion of the metal trace structure includes a shaft in communication with the channel wherein the shaft receives the underfill.

26. A method for underfilling a chip;

providing a substrate;

forming a solder mask over the substrate;

forming a metal trace structure within the solder mask; the metal trace structure

5 including a channel therein for the receipt of underfill; the metal trace structure

further including a central portion with arms radiating outwardly therefrom,

dividing the solder mask into separate areas;

the substrate, solder mask and metal trace structure comprising a substrate structure;

10 providing a chip having a series of solder bumps formed on the underside of the chip; the solder bumps being arranged in a pattern including openings;

placing the underside of the chip onto the substrate structure wherein the openings in the solder bump design overlie the substrate structure's metal trace structure; and

15 introducing underfill into the metal trace structure so that the underfill flows from the metal trace structure between the solder bumps in the solder bump design to underfill the chip.

27. The method of claim 26, wherein the underfill flows from the metal trace structure channel in the respective arms towards the outer portions of the chip.

28. The method of claim 26, wherein the arms each include a distal end.

29. The method of claim 26, wherein the metal trace structure is heated to a temperature of from about 25 to 90°C before the introduction of the underfill into the metal trace structure.

30. The method of claim 26, wherein the arms each include a distal end wherein the distal ends of the respective arms receive the underfill.

31. The method of claim 26, wherein the central portion of the metal trace structure includes a shaft in communication with the channel.

32. The method of claim 26, wherein the central portion of the metal trace structure includes a shaft in communication with the channel wherein the shaft receives the underfill.